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Final Technical Report

Quantitative studies of the magnetospheric boundary regions
and their auroral signatures

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Results obtained under this grant include characterization of the ion velocity distributions in the plasma sheet boundary layer, showing that the ions in this region have distinctive temperature anisotropies, in contrast to the ion velocity distributions in the central plasma sheet which are quasi-isotropic.

Nonadiabatic processes in the earth's magnetosphere were investigated for quiet and substorm times. We found that the quiet-time plasma sheet has an effective polytropic equation of state which is nonadiabatic. In addition during substorms nonadiabatic heating of the central plasma sheet takes place, giving rise to a positive correlation between plasma temperature and the Auroral Electrojet index. The heated plasma frequently appears in the form of a dispersionless injection of heated particles, virtually identical with the injections usually associated with geosynchronous orbit.

A large-scale survey of the central plasma sheet, reporting the plasma and magnetic parameters as functions of local time, distance from the earth, and distance from the neutral sheet, was completed. This paper is currently being revised for resubmission to the Journal of Geophysical Research. Finally, simultaneous high- and low-altitude observations of substorm onset were obtained with the ISEE 1 in the magnetotail and DE 1 over the auroral oval. In the six cases studied, it was found that even when ISEE 1 is in the current wedge, the lobe magnetic field strength typically does not exhibit classic loading-unloading, as predicted for the near-earth neutral model of substorms. The results of this study are being prepared for submission for publication.

Publications supported by this grant

Velocity distributions in the plasma sheet boundary layer, by C. Y. Huang, Adv. Space Res., 11, 143, 1991.

Nonadiabatic heating of the central plasma sheet at substorm onset, by C. Y. Huang, L. A. Frank, G. Rostoker, J. Fennell, and D. G. Mitchell, J. Geophys. Res., 97, 1481, 1992.

Nonadiabatic processes in the earth's magnetotail, by C. Y. Huang to be published, Adv. Space Physics, ed. by W.-H. Ip, 1992.

A statistical survey of the central plasma sheet, by C. Y. Huang and L. A. Frank, submitted to J. Geophys. Res., 1992.

Simultaneous high- and low-altitude observations of substorm onset, by C. Y. Huang, J.D. Craven, and L. A. Frank, to be submitted to J. Geophys. Res., 1992.